*Variable Stars.*

| Star. | R.A. h. m. | Decl. ° ′ | | | h. m | |
|---|---|---|---|---|---|---|
| U Cephei | 0 52·3 | 81 16 N. | July | 27, | 21 51 | *m* |
| Algol | 3 0·8 | 40 31 N. | ,, | 30, | 2 5 | *m* |
| δ Libræ | 14 54·9 | 8 4 S. | ,, | 29, | 22 50 | *m* |
| S Ophiuchi | 16 27·8 | 16 55 S. | ,, | 30, | | *M* |
| U Ophiuchi | 17 10·8 | 1 20 N. | ,, | 26, | 3 16 | *m* |
| [illegible] | | | | 26, | 23 24 | *m* |
| U Sagittarii | 18 25·2 | 19 12 S. | ,, | 25, | 0 0 | *M* |
| β Lyræ | 18 45·9 | 33 14 N. | ,, | 25, | 8 30 | *M* |
| T Sagittarii | 19 9·7 | 17 10 S. | ,, | 28, | | *M* |
| S Vulpeculæ | 19 43·8 | 27 0 N. | ,, | 25, | | *M* |
| η Aquilæ | 19 46·7 | 0 43 N. | ,, | 25, | 22 0 | *M* |
| R Vulpeculæ | 20 59·4 | 23 22 N. | ,, | 28, | | *M* |

*M* signifies maximum; *m* minimum.

## GEOGRAPHICAL NOTES.

THE new supplementary part of *Petermann's Mitteilungen* (No. 87) is devoted to Dr. R. von Lendenfeld's explorations in the Australian Alps in 1885–86. The region explored by Dr. Lendenfeld covers the greater part of the mountain districts of Victoria and New South Wales, and already in NATURE and elsewhere he has given some details concerning the geological and glacial results of his work. In the present memoir he gives a sketch of the Australian Alps in general, their geology, physiography, meteorology, flora, and fauna; he indicates the general physiognomy of the mountain system, its leading ranges, its valleys, and its river systems. He then devotes separate sections to the Kosciusko group and the Bugong group, and to a discussion of the Australian Ice period. There can be no doubt, Dr. Lendenfeld maintains, that at one time the Australian highlands were deeply glaciated, and that during the Tertiary the climate of the country must have been far richer in moisture than it is at the present day.

IN the new number (vii.) of *Petermann's Mitteilungen* Dr. Gerhard Rohlfs describes in a letter to Dr. Schweinfurth the results of his recent exploration of the limestone plateau which borders each side of the great Wadi Arabah, in Central Egypt. General Tillo brings together elaborate data bearing on the variation of the mean sea-level above or below a normal zero in the various seas of Europe; and Nikolaus Latken contributes a short paper on mining in East Siberia for 1874–85. There is an excellent map of the Khuriseb Valley, extending south-east from Walfisch Bay, West Africa, by Dr. Stapff, which, with the accompanying paper, gives a very full idea of the geology of the region.

A NUMEROUS and carefully-equipped Expedition is being sent out this summer by the Finnish Society of Botany and Zoology for the exploration of the interior of the Kola Peninsula. Another Expedition, organized by the St. Petersburg Society of Naturalists, set out last month to Petropaulovsk, to explore the White Sea and the Mediterranean coast.

UNDER Prof. O. Doering, the Government of the Argentine province Cordoba is establishing a network of meteorological stations which will begin work in January 1888. It is intended to form and equip 40 stations of the first order, 15 of the second, 10 of the third, and 10 of the fourth order. The instruments are being obtained from Berlin.

DR. L. BRACKEBUSCH, Professor of Geology and Mineralogy in the University of Cordoba, has recently returned from a five-months' excursion in the Cordilleras, bringing with him rich collections of minerals, and a mass of geological, geographical, and hypsometrical data.

THE Venezuelan Government has, it is stated, organized an Expedition for the geological and anthropological exploration of the territory on the Upper Orinoco and the Amazons.

AT a recent meeting of the Geographical Society of the Pacific, Prof. Davidson stated that his study of the ocean currents had brought him to the conclusion that a branch of the Japanese warm current, the Kuro Siwo, does pass into the Arctic Ocean through Behring Strait; and he promised to lay before the Society, at a future meeting, some information on the subject.

ACCORDING to the last mail from Zanzibar Lieut. Wissmann has arrived at the Kavala mission station on Lake Tanganyika. The explorer left Luluaburg on the Sankuru in November last, to traverse the unknown country in which are the sources of the Lulongo, the Chuapa, and the Lomami. He then meant to reach Lake Tanganyika by Nyangwé.

TO the last part of the *Verhandlungen* of the Vienna Geographical Society (Nos. 5 and 6 of Band xxx.) Herr W. Putick contributes a valuable paper on the subterranean district of Inner Carniola, the curious region known as the Karst.

## THE TECHNICAL EDUCATION BILL.

THE following is the speech delivered by Sir W. Hart Dyke on Monday in introducing the Technical Education Bill into the House of Commons:—

"In the observations that I am about to make I shall be as concise as possible, because I know that members are waiting to deal with other important matter. I feel that I am guilty of something like cruelty in introducing at this period of the session, after all we have gone through and with the labours still before us, any further legislation, but I plead in extenuation the fact that this is no new topic. It is one which has for some time past stirred up among the artisan classes considerable interest. Voluntary efforts have for some time past been made in this country in regard to technical instruction, and if I am asked why it is that we are going to endeavour to supplement by legislation what has been done the answer is that it is because we believe in the reality of this movement. For some years, not only among our artisan classes, but among our large employers of labour in industrial centres, it has been recognized that, though the commercial depression cannot be traceable to the lack of technical and commercial education in this country, yet that some part of it is due to the fact that Continental nations have had great advantages over us in regard to technical training for their youths, and that this has given them considerable commercial advantages over us. I am encouraged to hope that these proposals will meet with some acceptance from the House. If they enable the best material which is now turned out by our schools to continue longer in their school life and to start into some new educational groove for the benefit of themselves and of the industrial localities in which they live, and for the benefit also of the community at large, I think I may venture to urge that the time of the House will not be wasted in discussing these proposals. It is perfectly true that it may be urged that as I have not long held my present office I am rather rash in introducing this subject, and still more so considering that a Royal Commission has been sitting for some time and dealing with this great educational question. But I think that the House will agree with me that this is somewhat outside the scope of the Commission which is now sitting. There was a Royal Commission on Technical Education which reported in 1884. That Commission let in a flood of light on the question of technical instruction, and I should like for one instant to refer to their special recommendation as regards this country. As the House is aware, that Commission extended its labours to Continental countries, and conducted an exhaustive inquiry in connexion with this subject. The Commission pointed out that there was a considerable difference in respect of our treatment of the educational question and its treatment in countries abroad. They also pointed out that with the exception of France there was no European country of the first rank that has an educational Budget so large in amount as our own. They say that all our existing educational institutions will not alone accomplish the object aimed at, and that the localities must rely more than they have done hitherto upon their own special exertions. I may quote further from the Report of the Commission in reference to the advisability of introducing technical instruction into our schools. The Commissioners state that in Manchester, Sheffield, Birmingham, and other great centres, a considerable step has already been made in this direction, and they ask this pertinent question: "If we introduce needlework into girls' schools, why should not grants be made for manual instruction in boys' schools?" The Commissioners also recommended that rudimentary drawing should be continued through-out the standards. These are some of the recommendations with which the present Bill proposes to deal. I think I am not taking too sanguine a view of this scheme when I say that it will carry out all those proposals. The object of the Bill is to enable local authorities to provide for the establishment of technical schools or to assist in providing them, and also to give local authorities power to supplement existing teaching in elementary schools by technical instruction, whether by day or evening classes. There will also be a proposal in the Bill with regard to the ratepayers, to whom a power of vetoing any proposal under the Bill will be given. We propose that the Bill should be administered by the Science and Art Department—that is to say, that it should be administered subject to the directorate of that Department. We also propose that the Bill should have the limitation that no scholar should come under its operation until he has reached the sixth standard. The authorities for administering the powers conferred by the Bill will be School Boards where they exist, and where they do not exist town councils. I should just like to refer to Clause 4 of the Bill. To make the Bill acceptable to the ratepayers you must show that it is a cheap Bill and that consideration has been shown for them. Clause 4 is what I may call the operative clause of the Bill, and it enables local authorities to provide technical schools. Of course that would involve expense in building; but there is a sub-section of Clause 4 which enables the local authority to combine with any other local authorities. This will enable a system of combination to be adopted which will prove a great saving to the ratepayers; and, further, the next sub-section provides that the local authority may contribute towards the maintenance or provision of any technical school which has been established by any other local authority. It is further intended to include a provision that local authorities shall be empowered to rate for the purpose of supplementing any existing institution. These, I think, the House will admit are provisions which will enable this Bill to be worked cheaply. A further sub-section gives the local authority power to make any arrangements it may deem necessary or expedient for supplementing the technical instruction at present given in the schools. This provision I consider one of the most valuable in the Bill. It will enable technical instruction to be at once given without putting the ratepayers to any expense in building. I should like to refer for a moment to the limitation to the sixth standard. Though this will necessarily exclude many children, I think all interested in education will admit that the Bill should apply to the pick of our scholars, and that a good educational foundation should be required. With regard to the question of agricultural instruction, I am free to admit that the Bill, as drawn, can extend that instruction only to a very small extent, but I believe that the measure is capable of very considerable development, and that under certain of its sub-sections agricultural instruction may be afforded to a satisfactory extent. It is proposed to insert a provision in the Bill that where any local authority passes a resolution to establish a technical school a certain proportion of the ratepayers may demand a poll, but I am here at once met with a difficulty with regard to the metropolis—namely, that it is very wrong to propose to bring into existence the enormous voting power within the metropolis for such a purpose by this Bill. It may be asked how I propose to protect the ratepayers of the metropolis in regard to this matter. I have a proposal on the subject which has been drawn up by the Vice-Chairman of the London School Board, the hon. member for Worcestershire, and which has received the approval of the Chairman of that Board. I believe, from all I can gather, that that proposal will be popular with the present London School Board, and that it has been accepted by the hon. members for the metropolis who have been consulted in this matter, on the understanding that this policy alone will be carried out by the London School Board until the next election. I believe, also, that this proposal will be approved by the ratepayers of the metropolis. I have been asked by the hon. member for Worcestershire whether the scheme would not involve an extra charge for building, and I have been able to assure him that it will not do so. Therefore, Sir, I am prepared to admit that the members for the metropolis must be considered in this matter. Of course, if they think that further security to the ratepayers will be necessary it will be possible to insert an addition to this clause in the Bill to the effect that no action with reference to this Bill shall take place until after the next School Board election. I believe it would be a mistake to do anything of the kind; I believe that the interest of the ratepayers and of the great mass of working men in the metropolis may be safely trusted in the manner proposed by the Bill. Then, Sir, I may be asked this question, which, I think, is a very pertinent one. It is true that a vast amount has already been expended in the cause of technical instruction, and I may be asked: "If you once establish the principle of rating, will you not check the principle of voluntary effort?" I believe we shall do nothing of the kind, for several reasons. I believe that this will be an essentially popular measure among the working classes. I believe it will be impossible to check voluntary effort in a cause such as this where you supplement it by rates, for I believe that those who are spending money voluntarily are doing it in a cause which they know to be a very vast one, and that for all sums of money whenever spent in this cause more than compound interest will be repaid as the result. There are numerous instances in regard to this matter. It was only the other day I noticed that in Lambeth the Public Libraries Act was adopted. That is a case in point. What was the result there of adopting the principle of rating? I noticed that at the concluding meeting held, when arrangements were to be made for this new library under the system of rating, the hon. member for Barrow-in-Furness, who was in the chair, announced that a friend of his had not only given the ground but was going to build the whole library at his own cost. Numerous instances of the same type have come under my notice. Therefore I do not think we ought to dread that the establishment of voting power will check in any degree voluntary effort. I have only one other point to deal with—the administration of this Bill. We propose that this Bill shall be administered by the Science and Art Department at South Kensington. I have been anxious that the Bill should be so administered, for there we have a Department whose educational capacity has been thoroughly well tested. I have heard some hon. members attack the results of South Kensington as rather expensive. I am anxious that the House should be in a position to judge of the actual yearly expenditure at South Kensington, not only as regards administrative expenditure, but as regards its results. By the leave of the House, I shall therefore lay upon the table a document that will show in a concise form the actual expenditure at South Kensington for five years, both as regards administration and as regards results. Hon. members will then see how vast an increase there has been as regards payment by results and how small has been the increase of administrative expenditure. I should like to read to the House what that Department is now doing with regard to science and art. During 1886-87 there were 1936 schools or separate institutions in which instruction was given in one or more branches of science. There were 6976 classes in different branches of science, and the number of individual students under instruction was 100,419. At the May examination 127,900 papers were sent up for examination to South Kensington. I should like also to give some more instances to show the vast strides made in chemical instruction. In chemistry, 21,085 papers were worked at examinations. To show the advance made of late years in the facilities afforded for instruction in science of a thoroughly practical and experimental character, it may be mentioned that thirty years ago there were only one or two places where students could obtain laboratory instruction in chemistry, and that at very high fees. The Royal College of Chemistry, established in 1845, was one of these. Another was soon after started in Craig's Court. Now there are 234 chemical laboratories in connexion with the Science and Art Department in which students can obtain laboratory instruction at very low fees. There were 4257 separate benches at the last examination which afforded accommodation for 16,155 candidates. In the last session there were in operation 234 schools of art and 626 art classes, with 71,132 students in them; 50,000 were examined in May last, and the number of papers worked was 75,678. I should not for one moment have attempted to put the administration of this Bill under the Department of Science and Art at South Kensington if I had any doubt of its ability to work it with efficiency and economy. I thank the House for the attention with which it has heard me. I need not go again through the details. Happily this cannot be regarded as a party question. It is one which interests members on each side of the House, and although I do not submit the Bill as covering all the ground of technical instruction, I do believe that it is a measure which will do an enormous amount of good to our industrial population. In conclusion I would urge that, if it were only for the two provisions alone with regard to continuation classes and to evening classes, this Bill is worthy of the serious consideration of the House. I hope that hon. members will not at this time of the session overload the Bill with amendments.

## SCIENTIFIC SERIALS.

*Bulletin de la Société des Naturalistes de Moscou*, 1886, No. 3.—On two great comets (41 and 42) of 1886, by Th. Bredichin (in French).—On the *Agromyza lateralis* and its metamorphoses, by Prof. Lindeman (in German).—On the iron-bearing mud of Lipetzk, by E. Kislakovsky. It appears much like that of Franzensbad in Germany, and especially that of Ciechocinek in Poland.—On the Ammonites of the group *Olcostephanus versicolor* (Trautschold), by Mary Pavlow (in French, with two plates). Studying a rich collection of *Ammonites versicolor*, some of which reach 8 inches in diameter, while others have the size of a pin's head, the author considers them as belonging to the genus *Olcostephanus*, and establishes the following species, of which the last three are new: *O. versicolor*, *elatus*, *subinversus*, *inversus*, and *coronatiformis*.—On the importance of oxygen for plants, by W. Palladin (summed up in German). An elaborate research into the amount of matter destroyed in consequence of fermentation in an atmosphere devoid of oxygen, as also into the relations between the breathing of plants and their growth.—On the dynamic centra of a rotation-ellipsoid, with relation to earth, by K. Weihrauch, being a mathematical inquiry (in German) from which it results that the centres of attraction are situated in the earth nearer to the centre of figure than would be the case in an homogeneous ellipsoid of the same average density.—On the Algæ of Moscow, by A. Artari (in French), being a continuation of a former publication, and containing a list of eighty-five more species, chiefly Bacillariaceæ.—On the fauna of the lakes of the Slavyansk mineral waters, by P. Stepanoff. The fauna is mixed and contains representatives both of fresh-water and marine species, these latter being chiefly found amidst the Infusoriæ.—The annual report of the Society contains obituary notices of the late President of the Society, Dr. Renard.

No. 4.—Vascular plants of Caucasus, by M. Smirnoff. In this second paper (in French) the nebulosity of different parts of Caucasus is discussed, and data given.—Wild plants of the Government of Tambof, by D. Litvinoff, continued.—The species of *Thrips* living on corn in Middle Russia, by Prof. Lindeman (in German). The new species *Thrips secalina* and *Phlocothrips armata* are described together with former ones.—Zoological researches in the Kirghiz Steppe, by P. Nazarow, being a most valuable review of the fauna of the steppe, especially of its avifauna (with a map).—Speeches pronounced at the death of Dr. Renard.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, June 16.—"Experiments on the Discharge of Electricity through Gases." (Second Paper.) By Arthur Schuster, F.R.S.

In thinking over the phenomena presented to us in vacuum tubes, I always felt a difficulty owing to our ignorance of the conditions which hold at the surface of bodies, either suspended in or near the discharge, or even at the boundary of the vessel through which the discharge is passing. It is evident enough that if there is a flow of electricity on the surface of a non-conductor that flow must be tangential, but it is not so clear whether we are justified to conclude from this that there can be no normal forces at such surfaces, for it is not necessary that the flow should always take place along the lines of force.

Supposing we suspend two pieces of gold leaf, as in an electroscope, at any place in a partially exhausted vessel, and render them divergent by electrification, they should collapse as soon as the discharge begins to pass, if tangential forces only can permanently exist at their surface. This I have tested by experiment, and found to be the case.

A cylindrical glass vessel 38 centimetres high and 15 centimetres wide, was divided into two approximately equal compartments by a vertical metallic screen. There was an open space of about 5 millimetres between the screen and the sides of the vessel, a space of about 4 centimetres above, and 2·5 centimetres below the screen. One compartment contained two pieces of gold leaf, which could be charged from the outside. The other compartment contained two electrodes about 5 centimetres apart, and 2 centimetres from the screen; these distances could be varied during the experiment. The screen was always conducted to earth, and the electric fields on the two sides of the screen were therefore nearly independent of each other. When the gold leaves were electrified and divergent, and discharges from the induction-coil passed between the electrodes on the other side, no effect could be observed at atmospheric pressure: the gold leaves remained divergent.

At a pressure of about 4·3 centimetres of mercury, the effect I was looking for first appeared; when the discharge passed, the divergent leaves slowly collapsed, and as the pressure was further diminished the collapse took place more and more quickly.

We have here, then, even with the discontinuous discharge, a neutralization of all normal forces at the surface of the gold leaf.

It seemed to me to be interesting to observe more particularly the effects of the ordinary discharges we have at our command, at atmospheric pressure. I took two light balls, and suspended them so that they could be made to diverge by electrification. The electrodes (either spheres or points) of a Voss machine were placed at a distance of 3 inches from each other, and the electrified balls were placed at a distance of 9 inches from the discharge. The results are contained in the following table, in which the first two columns indicate whether the electrodes of the Voss machine were points or spheres. The third column gives the electrification of the balls, and the fourth column the results.

| Negative electrode. | Positive electrode. | Balls. | Result. |
|---|---|---|---|
| Sphere | Sphere | Positive | Balls collapse slowly |
| ,, | ,, | Negative | ,, remain divergent |
| Point | Point | Positive | ,, collapse quickly |
| ,, | ,, | Negative | ,, remain divergent |
| Sphere | ,, | Positive | ,, ,, ,, |
| ,, | ,, | Negative | ,, collapse slowly |
| Point | Sphere | Positive | ,, ,, quickly |
| ,, | ,, | Negative | ,, remain divergent |

It will be seen that when the two electrodes are similar, whether spheres or points, the balls collapse when they are electrified positively only; but that when one electrode is a sphere and another a point, the balls collapse if their electrification is of the opposite nature to that supplied by the point.

The conclusion thus arrived at, which will be proved beyond possibility of doubt in the second part of this paper, is this: we can only have tangential forces at the surfaces of vessels inclosing a gas through which a discharge is passing, provided no current crosses the surface.

After I had convinced myself that an electrified body placed in a partial vacuum through which an electric current is going, has its electricity quickly neutralized, it was doubtful still whether this neutralization was due to an actual discharge or merely to a covering of electrified particles of an opposite sign. The question is a vital one in all cases where potentials have to be measured. For we can only measure potentials of a gas by measuring the potential of a metal in contact with it; and if an electrified body is covered by electrified particles of a different sign, there is a finite difference of potential between the metal and the gas, and we should have to inquire carefully, in each particular case, how far such a difference would affect our conclusions.

The question is settled by the principal result of this paper:

A steady current of electricity can be obtained in air from electrodes at the ordinary temperature which are at a difference of potential of one-quarter of a volt only (and probably less); provided that an independent current is maintained in the same closed vessel.

In other words, a continuous discharge throws the whole vessel into such a state that it will conduct for electromotive forces which I believe to be indefinitely small, but which the sensitiveness of the galvanometer I used has prevented me from tracing with certainty below a quarter of a volt. There cannot be therefore a finite difference of potential between a gas and a metal in contact greater than that amount.

The same vessel was used as in the previous experiment.